

**SPECIES COMPOSITION AND ABUNDANCE OF FLEA BEETLES
(COLEOPTERA: CHRYSOMELIDAE) ASSOCIATED WITH MOIST
HABITATS IN ISPARTA AND BURDUR PROVINCES, TURKEY**

ALI GÖK AND EBRU GÜL ASLAN

Süleyman Demirel University, Science and Art Faculty, Biology Department,
32260 Isparta, Turkey(e-mail: aligok@fef.sdu.edu.tr; egul@fef.sdu.edu.tr)

Abstract.—An one-year survey was conducted on flea beetles associated with moist habitats in Isparta and Burdur provinces in the central part of the ‘Lake District’ in Turkey. Specimens were collected from various humid habitats divided into five major groups: moist meadows, marshes, moist pastures, lake sides, and stream banks. A total of 4,443 individuals belonging to 45 species were found, some of which are important pests of several wild plants. Habitat preference and relative abundance data are provided for each species. Among the genera collected in the study, *Chaetocnema* Stephens was the most abundant genus typically occurring in moist habitats. There was no significant difference in flea beetle species composition among the different habitat types. The highest species abundance and composition occurred in stream banks and moist meadows, whereas marshes have the lowest species abundance and composition.

Key Words: Flea beetles, moist habitats, species composition, abundance, Turkey

Alticinae is the largest subfamily of Chrysomelidae and can be distinguished from other Chrysomelidae by their greatly enlarged hind femora (Furth 1988). It is represented by 59 genera and more than 1,000 species in the Palearctic Region (Konstantinov and Vandenberg 1996).

Alticinae are highly specialized phytophagous insects and often follow their host plant distributions (Furth 1979, Jolivet 1988). Some of them are serious economic pests, causing direct damage and transmitting viruses; however, several, including species of *Longitarsus* Berthold and *Altica* Müller have been used successfully in the biological control of weeds (Booth et al. 1990). Some species of *Aphthona* Chevrolat are also commonly used in biological control of

weeds belonging to Euphorbiaceae (Konstantinov 1998, Jonsen et al. 2001, Konstantinov et al. 2001).

Flea beetles are common in almost all types of habitats. The richest flea beetle communities occur in open areas near forests or scrublands often associated with rivers or lakes and in various kinds of meadows (Konstantinov and Vandenberg 1996). Although most alticinae are terrestrial, several of them, e.g., *Altica*, *Chaetocnema* Stephens and *Longitarsus*, are attracted by subaquatic plants along streams (Jolivet and Verma 2002).

The Turkish Alticinae fauna consists of more than 250 species with recent contributions by Aslan et al. (1999, 2002) and Gök et al. (2002, 2003, 2004). Most of these works are faunistic studies. The Alticinae in Turkey are relatively poorly

studied from the ecological point of view including habitat use and host plant associations (Çilbiroglu and Gök 2004). Therefore, we regard this study as a preliminary step for future ecological studies on the Alticinae of Turkey.

Burdur and Isparta are located in the central part of the 'Lake District', which is one of the most important wetland areas of Turkey. This region includes a series of lakes of different sizes and ecological conditions. Its topography is composed of narrow and long mountain ranges, and depression areas in between (Yıldırım and Kebapçı 2004).

This work is part of the authors' studies on the Alticinae of Isparta and Burdur provinces, and the purpose is to assess flea beetle composition and abundance in habitats close to water.

MATERIALS AND METHODS

Site description.—The study was conducted in Isparta and Burdur provinces (between 29°33' and 31°20'E and 37°03' and 38°05'N), which are in the central part of the Lake District in Turkey, at the average altitude of 1,000 m. The area is located between central Anatolia and the Mediterranean region of Turkey; therefore, both arid and temperate climatic conditions are present. The sampled moist habitats are categorized into five groups as follows:

Moist meadows (MM): Includes natural areas along or near a watercourse dominated by gramineous vegetation and scattered small shrubs. These areas are drier than marshes with many more plant species. Plants from Lamiaceae, Asteraceae, Rosaceae, and Salicaceae are common.

Marshes (MA): Consists of open swampy areas that are closely associated with water, with rushes and sedges as the dominate plants. Plant species include *Phragmites* spp. (Poaceae), *Typha* spp. (Typhaceae), *Bolboschoenus* spp. (Cyperaceae), and *Carex* spp. (Cyperaceae).

There are also some other plants belonging to Asteraceae, Euphorbiaceae, and Brassicaceae.

Moist pastures (MP): These are open areas located at moist, high elevations on cool mountain slopes at an average of 1,000–1,500 m. The areas are divided with small springs, and mainly include annual herbaceous plant communities. Other parts away from the springs, are relatively drier. Dominant plants are species of Brassicaceae and rarely Ranunculaceae.

Lake sides (LS): Includes humid areas adjacent to lakes, often surrounded by agricultural lands, especially wheat fields. Asteraceae and Poaceae are the dominant plant families. There are also orchards in surroundings.

Stream banks (SB): These areas have the most diverse vegetation compared with other groups. There is a wide diversity of plants, with many species coexisting in a small area. The areas are characterized by woodshrub vegetation and their undergrowth of herbaceous plants. The dominant woodshrub cover consists of the following families: Fagaceae, Betulaceae, Salicaceae, and Rosaceae. The herbaceous cover is represented by plants of the Lamiaceae, Fabaceae, Asteraceae, Convolvulaceae, Scrophulariaceae, and Boraginaceae.

Sampling.—Fieldwork included survey of two representative stations for each of the five habitats (Fig. 1). The ten stations were sampled biweekly from March through September 2003 when the adult flea beetles are active. The stations were sampled by collecting at each site for 60 minutes with a sweep net. Sampling was made randomly from all existing plants. A total of 4,443 beetles were collected and identified using the keys by Warchalowski (2003). The number of adult individuals was counted for each species. The relative abundance of each species was determined by using the sample formula $n_i/N_T \times 100$ ($n_i =$

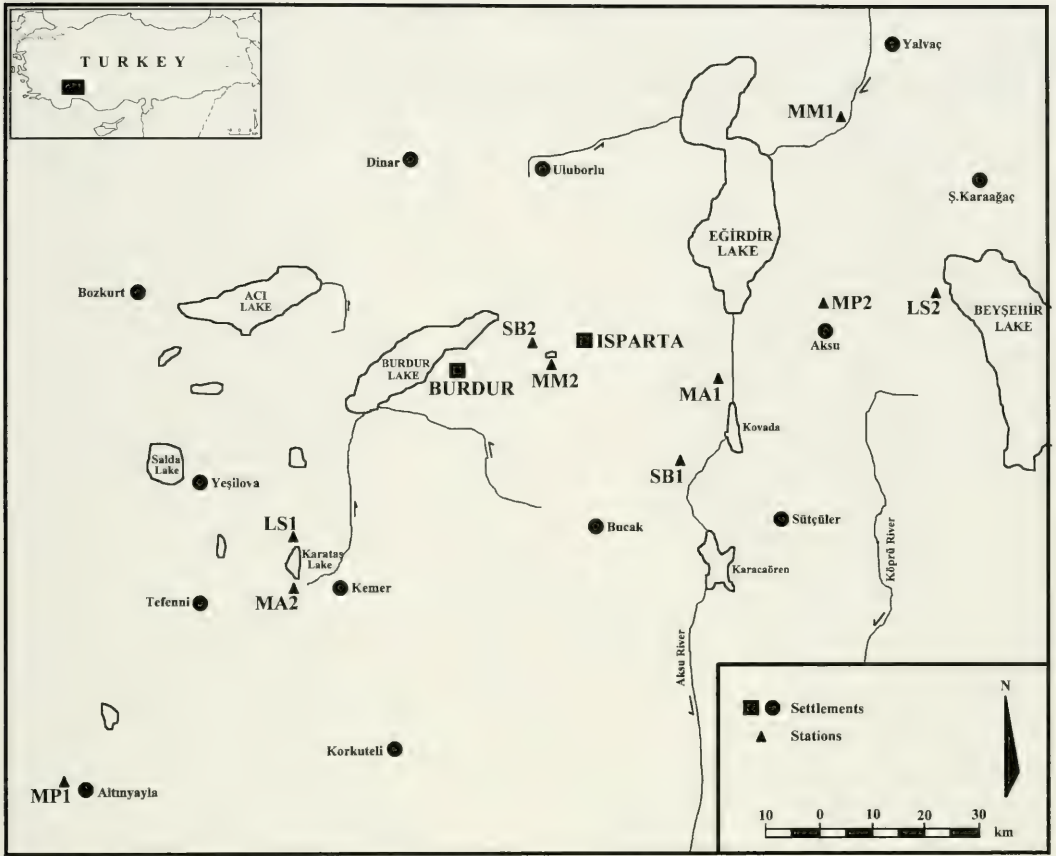


Fig. 1. The study area with stations: MM1, MM2, moist meadows; MA1, MA2, marshes; MP1, MP2, moist pastures; LS1, LS2, lake sides; SB1, SB2, stream banks.

individuals of species *i*; N_T = total individuals of all species). The specimens are deposited in the Department of Biology, Faculty of Art and Science, Süleyman Demirel University.

RESULTS AND DISCUSSION

In the study, forty-five species from ten genera of flea beetles were found associated with the five moist habitat types. Species associations with selected habitats are in Table 1. A list of flea beetle species collected is in Table 2, together with their number and relative abundance. *Longitarsus* and *Chaetocnema* were the largest genera with 12 and 10 species, respectively. *Podagrira* and *Dibolia* were the least species-rich

genera with one species each. Although *Longitarsus* has the highest number of species, *Chaetocnema* was the most abundant genus, representing 36.3% of the total number of individuals captured during the study period.

The number of species found in each habitat are as follows, in descending order: stream banks (SB) 32, moist meadows (MM) 28, moist pastures (MP) 21, lake sides (LS) 20, and marshes (MA) 19. The species richness did not vary significantly from habitat to habitat. More species were found in SB and MM, probably because these two habitats have the most diverse vegetation with many species of Lamiaceae, Asteraceae, Salicaceae, and Graminae, which

Table 1. Flea beetles associated with moist habitats. MM, moist meadows; MA, marshes; MP, moist pastures; LS, lake sides; SB, stream banks.

Species	MM	MA	MP	LS	SB
<i>Altica ancycensis</i> (Weise)	+				+
<i>Altica carduorum</i> Guérin-Méneville	+				+
<i>Altica deserticola</i> (Weise)	+	+			+
<i>Altica lythri</i> Aubé	+				
<i>Altica oleracea</i> (Linnaeus)	+	+	+	+	+
<i>Aphthona flaviceps</i> Allard		+		+	
<i>Aphthona nigriceps</i> (Redtenbacher)		+		+	
<i>Aphthona pygmaea</i> Kutschera		+	+		+
<i>Chaetocnema concinna</i> Marsham	+	+	+	+	+
<i>Chaetocnema conducta</i> (Motschulsky)	+	+	+	+	+
<i>Chaetocnema coyei</i> (Allard)	+	+	+	+	+
<i>Chaetocnema hortensis</i> (Geoffroy)			+	+	+
<i>Chaetocnema major</i> (Jacquelin du Val)		+		+	
<i>Chaetocnema mannerheimi</i> (Gyllenhal)			+	+	
<i>Chaetocnema montenegrina</i> Heikertinger			+	+	
<i>Chaetocnema sahlbergi</i> (Gyllenhal)	+		+		
<i>Chaetocnema scheffleri</i> (Kutschera)		+			+
<i>Chaetocnema tibialis</i> (Illiger)	+	+		+	+
<i>Crepidodera aurata</i> (Marsham)	+		+	+	+
<i>Crepidodera aurea</i> (Geoffroy)	+				+
<i>Crepidodera lamina</i> (Bedel)	+				+
<i>Dibolia occultans</i> (Koch)	+				+
<i>Longitarsus bertii</i> Leonardi		+	+		+
<i>Longitarsus kutschera</i> Rye		+	+		+
<i>Longitarsus longipennis</i> Kutschera	+	+	+	+	+
<i>Longitarsus luridus</i> (Scopoli)	+	+	+	+	+
<i>Longitarsus lycopi</i> (Foudras)	+	+			+
<i>Longitarsus melanocephalus</i> (De Geer)			+	+	
<i>Longitarsus parvulus</i> (Paykull)	+				+
<i>Longitarsus pellucidus</i> (Foudras)	+		+		+
<i>Longitarsus pratensis</i> (Panzer)	+				+
<i>Longitarsus scutellaris</i> (Rey)	+				+
<i>Longitarsus solaris</i> Gruev	+			+	
<i>Longitarsus succineus</i> Foudras	+		+		+
<i>Neocrepidodera ferruginea</i> (Scopoli)	+		+		+
<i>Neocrepidodera impressa obtusangula</i> (J. Daniel)					+
<i>Phyllotreta aerea</i> Allard			+	+	+
<i>Phyllotreta diademata</i> (Foudras)		+			
<i>Phyllotreta vittula</i> (Redtenbacher)		+			
<i>Podagrica menetriesi</i> (Faldermann)	+			+	
<i>Psylliodes anatolicus</i> Gök and Çilbıroğlu	+				+
<i>Psylliodes circumdatus</i> (Redtenbacher)				+	
<i>Psylliodes cupreus</i> (Koch)	+	+	+	+	+
<i>Psylliodes magnificus</i> Gruev	+				+
<i>Psylliodes reitteri</i> Weise					+

are characteristic food plant families of most Alticinae (Çilbıroğlu and Gök 2004). According to Lawton (1983), changes of plant species composition and diversity influence the habitat complexity, hence the diversity and richness

of phytophagous insect communities. The species numbers found in other three habitats (MP, LS, MA) were very similar (Fig. 2).

As shown in Table 1, eight species are found in all habitats: *Longitarsus long-*

Table 2. Numbers and percent abundance of flea beetles collected.

Species	Number Collected	Relative Abundance (%)
<i>Altica oleracea</i> (Linnaeus)	585	13.17
<i>Chaetocnema coyei</i> (Allard)	542	12.2
<i>Chaetocnema tibialis</i> (Illiger)	379	8.53
<i>Altica deserticola</i> (Weise)	272	6.12
<i>Chaetocnema concinna</i> Marsham	214	4.82
<i>Longitarsus lycopi</i> (Foudras)	180	4.05
<i>Longitarsus pratensis</i> (Panzer)	175	3.94
<i>Neocrepidodera ferruginea</i> (Scopoli)	174	3.92
<i>Crepidodera aurata</i> (Marsham)	163	3.67
<i>Chaetocnema mannerheimi</i> (Gyllenhal)	151	3.4
<i>Chaetocnema major</i> (Jacquelin du Val)	141	3.17
<i>Longitarsus parvulus</i> (Paykull)	122	2.74
<i>Chaetocnema conducta</i> (Motschulsky)	104	2.34
<i>Longitarsus longipennis</i> Kutschera	102	2.29
<i>Neocrepidodera impressa obtusangula</i> (J. Daniel)	87	1.96
<i>Longitarsus pellucidus</i> (Foudras)	82	1.85
<i>Longitarsus melanocephalus</i> (De Geer)	81	1.82
<i>Dibolia occultans</i> (Koch)	81	1.82
<i>Psylliodes cupreus</i> (Koch)	76	1.71
<i>Aphthona pygmaea</i> Kutschera	72	1.62
<i>Phyllotreta aerea</i> Allard	72	1.62
<i>Phyllotreta vittula</i> (Redtenbacher)	62	1.39
<i>Longitarsus succineus</i> Foudras	51	1.15
<i>Longitarsus luridus</i> (Scopoli)	48	1.08
<i>Phyllotreta diademata</i> (Foudras)	48	1.08
<i>Podagrica menetriesi</i> (Faldermann)	32	0.72
<i>Aphthona flaviceps</i> Allard	31	0.7
<i>Psylliodes anatolicus</i> Gök and Çilbıroglu	30	0.67
<i>Chaetocnema hortensis</i> (Geoffroy)	28	0.63
<i>Psylliodes magnificus</i> Gruév	27	0.61
<i>Longitarsus bertii</i> Leonardi	27	0.61
<i>Crepidodera lamina</i> (Bedel)	24	0.54
<i>Chaetocnema scheffleri</i> (Kutschera)	24	0.54
<i>Chaetocnema sahlbergi</i> (Gyllenhal)	22	0.5
<i>Longitarsus scutellaris</i> (Rey)	22	0.5
<i>Psylliodes circumdatus</i> (Redtenbacher)	21	0.47
<i>Crepidodera aurea</i> (Geoffroy)	18	0.41
<i>Altica carduorum</i> Guérin-Méneville	17	0.38
<i>Altica ancyrensis</i> (Weise)	13	0.29
<i>Longitarsus kutschera</i> Rye	12	0.27
<i>Aphthona nigriceps</i> (Redtenbacher)	11	0.25
<i>Chaetocnema montenegrina</i> Heikertinger	8	0.18
<i>Longitarsus solaris</i> Gruév	6	0.14
<i>Altica lythri</i> Aubé	5	0.11
<i>Psylliodes reitteri</i> Weise	1	0.02

ipennis, *Longitarsus luridus*, *Altica oleracea*, *Chaetocnema concinna*, *Chaetocnema conducta*, *Chaetocnema coyei*, *Chaetocnema tibialis*, and *Psylliodes cupreus*. Four species were found in only one habitat type; of which two were in

the genus *Phyllotreta*, and two in *Psylliodes*: *Phyllotreta diademata*, *Phyllotreta vittula*, *Psylliodes circumdatus* and *Psylliodes reitteri*.

Phyllotreta mainly prefer plants from Brassicaceae and Resedaceae which grow

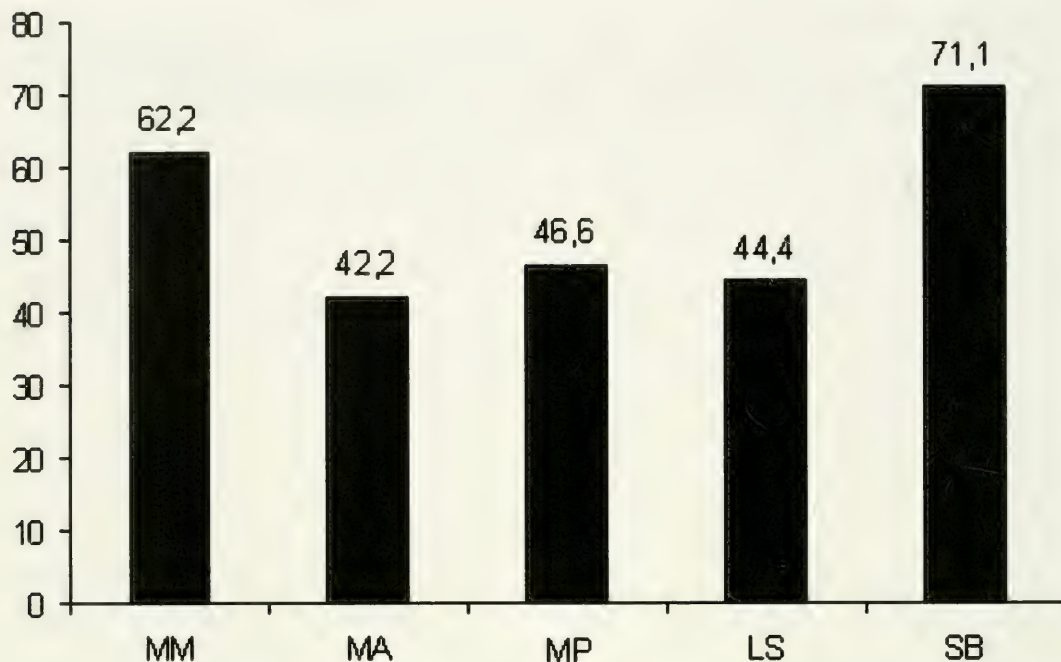


Fig. 2. Species percentage of the five habitats studied. MM, moist meadows; MA, marshes; MP, moist pastures; LS, lake sides; SB, stream banks.

in cultivated areas, roadsides, orchards, and shrubs (Mohr 1966, Furth 1979, Matsuda 1988, Nielsen 1988). The low density of Brassicaceae in moist habitats may be the reason for limited habitat occurrence of *Phyllotreta*. Many species of *Psylliodes* are also Brassicaceae feeders (Furth 1983). The restriction of each *Psylliodes* species to one habitat may be temporary or accidental.

The most abundant species in number of individuals were *Altica oleracea*, *Chaetocnema coyei*, and *Chaetocnema tibialis* with 13.17%, 12.2%, and 8.53%, respectively. *Psylliodes reitteri* was the rarest species, represented by a single individual.

Density and species composition of phytophagous beetles are affected by many factors, such as vegetation, humidity, temperature and host plants (Gillott 1995). Our studies revealed that moist habitats are preferred by a large number of moisture-loving flea beetles.

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